Accommodations Toolkit

Text-to-speech (Computer Generated Voice): Research

This fact sheet on **text-to-speech** is part of the *Accommodations Toolkit* published by the National Center on Educational Outcomes (NCEO). It summarizes information and research findings on the use of text-to-speech with computer-generated speech as an assessment accessibility feature or accommodation for students with disabilities. [1] The toolkit also contains a summary of states' accessibility policies for text-to-speech.

What is text-to-speech with computer-generated speech? Text-to-speech with computer-generated speech refers to technology that reads aloud written directions and test items employing computer software to generate a synthesized voice. This version of audio delivery is different from others that use the human voice, either in-person by a test administrator at the time of the assessment or a previously recorded human voice. It is important to note that students can be provided with text-to-speech in several ways (e.g., read aloud test directions only; read aloud items and directions; read aloud items, passages, and directions) (Lee et al., 2021).

What are the research findings on who should use this accommodation? Not all students benefit from using text-to-speech and care should be used to ensure that policies target the small number of students who may benefit from using this accommodation. Some students who have print-related disabilities may find it useful, including those with reading-related learning disabilities (Young, 2017) and visual impairments (Hansen et al., 2016). According to Flowers et al. (2011), many states' accessibility policies for summative assessments used for accountability allow text-to-speech for students in grades 3 through 11 with health impairments, attention deficit disorders, intellectual disabilities, or specific learning disabilities.

What are the research findings on implementation of text-to-speech with computer-generated speech? Ten studies provided evidence about the impact of text-to-speech using a synthesized voice on assessment performance. Some of the studies showed positive or negative effects, while other studies found little or no impact.

- Two studies indicated that the text-to-speech accommodation using a synthesized voice had no significant effect on performance for students with disabilities when compared to the use of no accommodations. Meyer & Bouck (2014) found that students with reading-related learning disabilities in middle school scored no differently on reading comprehension using text-to-speech software than with no accommodations. Another study found that students with learning disabilities in grade 5 scored the same when completing test-like writing tasks using a text-to-speech accommodation with synthesized voice as they did without any accommodations (Silió & Barbetta, 2010).
- Similarly, two studies that compared human read-aloud and text-to-speech delivery found that students did not benefit more from speech with synthesized voice than from human read-aloud delivery or no accommodation (Flowers et al, 2011; Meyer & Bouck, 2017).
- Two very small studies indicated that the text-to-speech accommodation using a synthesized voice had some benefit for some students. Young (2017) found that three of four high school students with learning and additional disabilities improved their performance on an assessment measuring vocabulary, literary analysis, and comprehension when provided with the computer-generated text-to-speech. Hansen et al. (2016) studied the use of multiple accommodations to provide three students (grades 8 and 9) with visual disabilities access to science simulation items. The study found that text-to-speech via a screen reader allowed for easy navigation of the test item, but was not enough to provide students with a full understanding of the test items.
- One study indicated that students with disabilities experienced negative effects when using synthesized text-to-speech programs. An analysis of three states' reading comprehension scores indicated that grade 4 students with various disabilities performed better without computer-based text-to-speech software than with it (Ricci, 2015).
- There were mixed findings across two studies that explored whether the use of reading pens with synthesized voices to read aloud difficult words improved student performance. Schmitt et al. (2011) found that when a reading pen was used to convert text to synthesized speech, two of three high school students demonstrated comprehension improvements. In a study of middle school students, including students with and without disabilities, Thurlow et al. (2010) found that just 11 of the 76 of the participants performed better in reading comprehension; 65 of the 76 students experienced no benefit.

What perceptions do students and teachers have about text-to-speech with computer-generated speech? Six research studies examined student and teacher perceptions of the use of text-to-speech with a synthesized voice. In all the studies, students had favorable perceptions of text-to-speech software. They preferred synthesized audio to in-person oral delivery (Flowers et al., 2011), were comfortable using the software (Higgins & Katz, 2013; Lee et al., 2021), reported stronger information recall, and liked managing the speed of speech (Meyer & Bouck, 2014; Young, 2017).

Students found the reading pen format helpful to scan and decode difficult words (Schmitt et al., 2011; Thurlow et al., 2010). Flowers et al. (2011) found that teachers had favorable perceptions of the use of text-to-speech using a synthesized voice.

What have we learned overall? Text-to-speech using computer-generated speech has been broadly provided to allow students with disabilities to more easily access academic assessments even though the research on synthesized text-to-speech accommodations has had mixed findings. Across studies, students with disabilities have experienced positive effects, no effects, and negative effects from using this accommodation. Students who do not know the content will not do well on an assessment with or without the use of text-to-speech. However, students, as well as their teachers, had positive perceptions of synthesized text-to-speech, even in situations where there were no performance benefits from using the accommodation.

Footnotes

[1]
Research on text-to-speech summarized here is also available in NCEO's searchable *Accommodations for Students with Disabilities Bibliography* (https://nceo.info/Resources/bibliographies/accommodations/bibliography (https://nceo.info/Resources/bibliographies/accommodations/bibliography)) and in NCEO syntheses of research from 2010 through 2021 (see summaries for: 2009-2010 (https://nceo.umn.edu/docs/OnlinePubs/Tech65/TechnicalReport65.pdf), 2011-2012 (https://nceo.umn.edu/docs/OnlinePubs/Synthesis94/Synthesis94.pdf), 2013-2014 (https://nceo.umn.edu/docs/OnlinePubs/Report402/NCEOReport402.pdf), 2015-2016 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport412.pdf), 2017 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport418.pdf), 2018 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport423.pdf), 2019 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport433.pdf), 2020 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport436.pdf), 2021 (https://nceo.umn.edu/docs/OnlinePubs/NCEOReport438.pdf). See the reports and online bibliography for additional information about the criteria used to identify studies included in this fact sheet.

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